

## FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2)



### Army ACAT ID Program

Total Number of Systems:	59,522
Total Program Cost (TY\$):	\$1.8B
Average Unit Cost (TY\$):	\$27K
Full-rate production:	2QFY00

### Prime Contractor

TRW

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

Two important components of the Army's Battle Command System and the Battlefield Digitization effort are the Force XXI Battle Command, Brigade and Below (FBCB2) program and its supporting Tactical Internet. FBCB2 is a digital, battle command information system intended to provide commanders, leaders, and soldiers—from brigade to individual soldier and across all the Battlefield Functional Areas—improved command and control and enhanced situational awareness information. FBCB2 primarily consists of software, but will also include a ruggedized computer for those users and platforms without an existing computer system. Systems with existing computers capable of hosting FBCB2 software will receive the Embedded Battle Command software—a subset of FBCB2. Embedded systems for the near term include the M2A3 Bradley Fighting Vehicle, the M1A2 System Evaluation Plan (SEP) ABRAMS Tank, and the Army Tactical Command and Control Systems.

FBCB2's primary functions are to send and receive automatic position-location reports derived from its interface with the Global Positioning System, and to send and receive command and control message traffic via digital over-the-air radio transmissions. The Tactical Internet is the network of radios

and routers that provide linkages to connect the myriad FBCB2 platforms (both vertically and horizontally) across the combined arms force. The Tactical Internet consists of the Enhanced Position Location Reporting System, the Single-Channel Ground and Airborne Radio System, and the Internet Controller Router.

FBCB2 and the Tactical Internet perform as a network within brigade-sized and smaller units. At the Brigade and Battalion Tactical Operations Centers, the Tactical Internet interfaces with the Army Tactical Command and Control System (ATCCS), an ethernet-based local area network of computers representing the functional areas of intelligence, maneuver, air defense, combat service support, and fire support. This interface permits information collected and disseminated via ATCCS systems to be rapidly passed through the Tactical Internet to FBCB2 computers. Likewise, the position reports of individual and unit locations are passed upwards through the FBCB2 and Tactical Internet into the ATCCS system for dissemination throughout the force. The FBCB2 and Tactical Internet help provide *information superiority* to the *dominant maneuver force*. The basis for the new operational concepts in *Joint Vision 2010* is improved command and control.

## **BACKGROUND INFORMATION**

The Army initiated the Force XXI Battlefield Digitization program in 1994, with the intent to proliferate and integrate digital communications and information management technologies across the combined arms spectrum. The Army's efforts have been demonstrated in a series of Advanced Warfighting Experiments. The central hypothesis throughout Digitization experimentation has been: **"If information age, battle command capabilities and connectivity exist across all battlefield operating systems, then increases in lethality, survivability, and op-tempo will be achieved."** The first Advanced Warfighting Experiment to examine FBCB2 was Task Force XXI, conducted June 1996–March 1997, with the culminating event at the National Training Center.

The Task Force XXI Advanced Warfighting Experiment equipped a brigade from the 4th Infantry Division with FBCB2 (Applique) hardware and software on all of its 1,600-plus vehicles. The brigade trained with the new digital equipment, among dozens of other initiatives, for about eight months then deployed to the National Training Center for a series of force-on-force battles with a live opposing force. Due to immaturity of the FBCB2 and Tactical Internet, the degree of digital connectivity achieved during the Task Force XXI Advanced Warfighting Experiment was not sufficient to achieve the premise of the central hypothesis and not suitable for tactical operations. The immaturity also impacted the training readiness of the unit and development of digital tactics, techniques, and procedures. In spite of these challenges, the digitized brigade performed similarly to the non-digitized baseline brigades at the National Training Center—a result that (with follow-on constructive modeling) the Army used to support continued program acceleration.

A conditional Milestone I/II decision for FBCB2 was made in July 1997, pending completion and approval of the FBCB2 TEMP and ORD. The Joint Requirements Oversight Council approved the ORD in August 1998, however the TEMP remains an outstanding requirement. Although the Army Milestone Decision Authority directed at the July 1997 review that FBCB2 transition from an Acquisition Category (ACAT) III program to ACAT II, in spring 1999 the Army Acquisition Executive recommended that FBCB2 be redesignated as an ACAT IC when the ACAT I dollar threshold was exceeded. In September 1999, the Defense Acquisition Executive determined that the programmatic challenges of FBCB2 warranted its designation as an ACAT ID program.

The most recent testing of FBCB2 and the Tactical Internet were conducted in FY98. Developmental Field Test-1 (FT-1) was conducted at Ft. Huachuca, AZ. FT-1 examined system performance and readiness for the subsequent Limited User Test-1 (LUT-1). It employed 61 FBCB2-equipped nodes, including 14 mobile platforms. LUT-1 was conducted at Ft. Hood with a Battalion Task Force of 232 platforms equipped with FBCB2. An opposition force was included to operationally stress the unit's employment of FBCB2, and passive electronic warfare monitoring was conducted. FBCB2 software tested during FT-1 and LUT-1 were missing several critical capabilities called for in the ORD requirement, and as a result of poor quality control during computer hardware assembly, many heat-related failures were experienced. Nonetheless, FBCB2 system performance during FT-1 and LUT-1 represented a significant improvement over that observed during the Task Force XXI Advanced Warfighting Experiment. The friendly situational awareness information provided by FBCB2 and the new Tactical Internet architecture were generally accurate and timely, and the improved system stability permitted soldiers to employ FBCB2 information during the execution of their missions. The stability also permitted the test unit to achieve a higher state of training than the Task Force XXI unit and furthered the refinement of digital tactics, techniques, and procedures.

## **TEST & EVALUATION ACTIVITY**

The only testing of FBCB2 during FY99 involved Reliability Demonstration Testing conducted from June-July in the Electronic Proving Ground's environmental chambers. This test was conducted to demonstrate that improved quality control in the manufacturing process could alleviate a large percentage of the heat-related hardware failures experienced during LUT-1. In addition to improved quality control, the program envisions a reconfiguration of the FBCB2 computer's internal components to improve the heat transfer away from heat-sensitive components.

Other activities included the evaluation of LUT-1 results and development of the FBCB2 SEP. The first briefing of the SEP by the Army in December 1998 resulted in DOT&E rejection of the plan due to shortfalls that would preclude FBCB2 from being adequately tested. As outlined in a December 22, 1998 DOT&E memorandum, FBCB2 testing must be conducted in an operational system-of-systems environment with live force-on-force events comparable to an analog baseline supporting the force effectiveness evaluation. Additionally, the memorandum observed that FBCB2 functionality proposed for IOT&E would be immature and not production representative. In June, the Army proposed a new SEP built around a restructured FBCB2 Program with heavy system-of-system digitization emphasis. The revised Test and Evaluation Strategy includes a major event at the National Training Center, (LUT-3), with three baseline events identified for comparison of the force-on-force results. The revised strategy also adds 25 months to the schedule to ensure appropriate hardware and software maturity prior to IOT&E. In many ways, the revised FBCB2 strategy defines the critical path of the Army's Battlefield Digitization effort. The second SEP briefing was favorably received by DOT&E.

As the FBCB2 program was restructured, increased emphasis on the role of the Army Battle Command System hardware and software became clear. Under the revised architecture, FBCB2 hardware will not be present in Tactical Operations Centers: situation awareness information will be processed by Embedded Battle Command software, and command and control functions (messages, orders, overlays, etc.) will be performed by Army Battle Command System software, both hosted on ATCCS workstations. Therefore, any testing including units above the company level must include ATCCS systems and requisite interoperability between FBCB2 and Army Battle Command System software. The result is that the spiral development of FBCB2 must coincide with the multiple spiral developments of all the Battlefield Digitization programs, an enormous challenge for configuration management of software, testing, evaluation, and acquisition reform.

## **TEST & EVALUATION ASSESSMENT**

The Reliability Demonstration Test of FBCB2 hardware in a chamber test achieved a three-fold increase in the number of hours between essential function failure when compared to LUT-1 results. These results put the program in reach of the newly revised threshold reliability requirement if they can be reproduced in the operational environment when employed by soldiers.

The most recent information regarding FBCB2 operational performance is based on the LUT-1 conducted in August 1998. LUT-1 results demonstrated significant improvements over Advanced Warfighting Experiment results, albeit with a smaller network: command-and-control message completion rates increased from approximately 30-80 percent, and speed-of-service was improved from approximately three minutes to less than four seconds. Situational Awareness message completion rates rose from 25 percent to nearly 65 percent, and speed-of-service decreased from approximately one minute to less than eight seconds. Whether these results are “scalable” from a battalion task force to a brigade task force remains to be seen, as there were observed trends that indicate situation awareness message completion rates and speed-of-service were degraded as the number of transmitting platforms increased during this battalion-level test.

Qualitative information also indicates that the use of FBCB2 assists commanders in control of maneuver and synchronization of combat power. An example of this occurred during LUT-1 when two companies successfully performed a passage of lines over difficult terrain, a feat that the battalion commander stated he would not have attempted without FBCB2. Other observations indicate that situation awareness provided by FBCB2 permits commanders to focus more of their time on actually commanding, as less time is required to track positions and movement. Soldiers have also been positive about FBCB2, and although they recognize the system’s immaturity, they feel it already enhances their performance.

In spite of the significant improvements observed during FY98 testing for FBCB2, the current state of FBCB2 capabilities are interim, with a number of critical enhancements needed to achieve an effective and suitable capability. These enhancements include a robust network management capability to monitor the network’s health and respond to identified problems, interoperability with Army Tactical Command and Control Systems, and rapid reestablishment of the network when communication/combat losses occur or a task organization change is required. These capabilities will be provided via and across multiple Digitization programs, all of which are to be available for testing in FY00.

Scheduled FBCB2 testing in FY00 includes Field Test-2 and a Force Development Test and Experiment, where critical tactics, techniques, and procedures for the FBCB2 IOT&E and the Digital Battlefield will be validated. Although the revised Program and Test and Evaluation Strategy is robust, we remain concerned that the pressure to achieve the Army’s goal of First Digitized Division by FY00 may result in expediciencies that are not in the best long term interest of the Battlefield Digitization effort. One example of this would be maintaining the FY00 test schedule when the delivery of significant functionality has not occurred in time to adequately conduct preliminary risk reduction or training events. Another example would be to prematurely state that “Go-To-War” capability exists before adequate examination of system-of-system performance in non-benign environments and across the array of climates and scenarios. There is significant potential for FBCB2 to contribute to improved unit performance on the Digital Battlefield, wherever that may be, but this will only be realized through disciplined development, experimentation, testing, and performance evaluation across all appropriate employment scenarios.